Enhanced Photosensing Characteristics of Al/Mg Co-Doped CdS CQDs Photodetectors for Visible to NIR Detection

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Abstract:

Development highly performed photodetectors (PDs) using wide band gap semiconductors is a significant field of research in the present scenario. This research investigates the fabrication and performance evaluation of multi-ion doped photodetectors, particularly in the visible to NIR spectrum, utilizing Al/Mg co-doped CdS colloidal quantum dots thin films (CQDs TFs). The Al/Mg co-doped CdS QDs were synthesized using chemical co-precipitation method, followed by the deposition of TFs on p-type silicon substrates by spin coating method. Comprehensive electrical measurements were conducted to assess the devices' performance under varying illumination wavelengths. The results reveal that co-doping significantly enhances the detectivity (D) and responsivity (R) of the PDs. The device exhibited the highest detectivity value of 4.57 x 10^{13}cmHz$^{1/2}$W^{-1} under 845 nm illumination, indicating superior performance in the NIR region. Additionally, the maximum *R* values is estimated to be 11.31 AW^{-1} with optimal performance achieved at a bias voltage of 5V. The results demonstrate that the incorporation of both ions effectively improves the photosensing capabilities of CdS-based PDs, paving the way for advanced applications in optoelectronic devices. This study contributes to the understanding of co-doping strategies in enhancing the performance of semiconductor PDs, with implications for future research and development in the field.